

MONTHLY NOTICES

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No. 6

Dr. A. A. COMMON, LL.D., F.R.S., President, in the Chair.

The following candidates were proposed for election as Fellows of the Society, the names of the proposers from personal knowledge being appended :—

Rev. J. Dunne-Parker, LL.D., Bennington House, Stevenage, Herts (proposed by Robert Wigglesworth) ;

John A. Ferguson, Newlands, Oak Hill, Surbiton, S.W. (proposed by H. B. Chamberlin) ;

George Andrews Hill, Assistant-Astronomer, United States Naval Observatory, Washington (proposed by James E. Keeler) ; and

Ernest William Hobson, M.A., Fellow of Christ's College, Cambridge (proposed by J. W. L. Glaisher).

Seventy-one presents were announced as having been received since the last meeting, including amongst others :—

Three pastel drawings of the Moon, by John Russell, R.A., presented by Mr. McClean ; eight untouched enlargements of portions of the Moon, from negative by MM. Lœwy and Puiseux, presented by Dr. L. Weinek ; an astronomical scrap album, bequeathed by the late Mrs. Jackson Gwilt.

On a Modified Form of the Cassegrain Telescope.

By William R. Brooks, M.A.

The modified form of the Cassegrain telescope with which Dr. Common has been recently experimenting was thoroughly worked out by me in 1884, and with results equally satisfactory and promising. I am glad to be able to corroborate the results so far reached by Dr. Common. The experiments made by the writer eleven years ago, were in connection with a metal speculum of seven inches aperture and about ten feet focal length, which was placed in my hands for repolishing and refiguring. It was mounted as a Herschelian, and the mirror had no central hole. Therefore, to try it as a Cassegrain, which I was anxious to do, the eye-tube was placed to one side of the large mirror. Finally the small convex mirror was placed outside the path of rays proceeding from the object to the large speculum, the eye-tube was moved by a series of trials farther from the speculum, when it was found that the distortion caused by the tilting of the large speculum could be perfectly corrected by the proper inclination of the small convex mirror, and perfect definition was the result.

A flat small mirror was also tried in place of the small convex mirror, and with equally good results. In the use of the flat small mirror no increase of the focal length resulted, and this where compactness of the instrument was sought would be a great advantage. The entire length of the telescope would then be one-half of the focal length of the large speculum.

I would here call attention to the fact that the correction of the distortion caused by the tilting of the large speculum can be corrected by the proper tilting of the small flat mirror as well as if it were convex. I consider this correction independent of the correction of the curvature of the mirrors for figure, whatever these figures of curvature may be. The result of my work in this matter led me to the opinion that whatever corrections for figure were required for the large and small mirrors when placed in the ordinary position of the Cassegrain telescope would be correct for them when the small mirror was placed outside, as in this modified form. If a flat small mirror be used, the large speculum should be parabolic.

If a convex small mirror be used, the correction for figure may be divided between the two, as commonly practised. All the advantages pointed out by Dr. Common in the direction of virtual great focal length, and hence large resultant images, with a minimum length of instrument, were fully corroborated by my tests.

The other advantages will also, it seems to me, be obvious to the practical astronomer and optician.

Circumstances prevented me from carrying these trials forward on a more extensive scale at that time, although I always hoped to resume them. I wish here to express my gratification that one so able, in every sense of the word, as our esteemed President, has undertaken to elaborate this very promising form of telescope. From my own experience I venture to predict that such work will be crowned with perfect success.

Smith Observatory, Geneva, N.Y., U.S.A.:
1895 March 6.

The Brachy Telescope of Messrs. Fritsch and Forster, of Vienna.
By A. A. Common, LL.D., F.R.S.

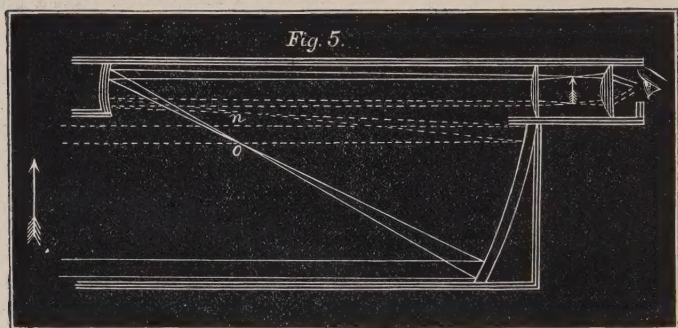
At the last meeting of this Society I mentioned that I had received a courteous letter from Mr. Fritsch, of Vienna, stating that he and Mr. Forster had invented the form of telescope I described in my note of January 8, and asking that their claim to priority in the invention should be acknowledged by the Royal Astronomical Society. I then stated that I could not allow this claim, as I had that morning read a letter (in the *English Mechanic*) from a Mr. Coates, of Manchester, in which he stated that a similar telescope was described in a book he possessed, published in 1825. Mr. Fritsch expresses surprise that I had not seen any description of the telescope, which ran through nearly all the periodicals of science. I expressly state in my paper that the only information I had was derived from Dr. Schroeder, who stated that this form of telescope had been made in Germany many years ago. From what he said I understood nothing had been published about this telescope, as he spoke of writing a paper on the theory of the form of this telescope. He gave me some data when I was thinking of making my 5-foot telescope, and I went so far as to make a 6-inch telescope on those data, which, however, did not succeed so well as I expected, nor so well as the combination I give in my note.

Mr. Coates's letter was written in answer to a letter in a previous number of the *English Mechanic*, written by Mr. W. R. Brooks, describing some experiments made in 1884, asking if he should prove to be the prior inventor (although he does not appear to have published any account before this) that the telescope should be called the "Brooksian Reflector," and so far as I can see neither Mr. Fritsch nor myself could object to this name for that form where the distortion of the image produced by oblique reflection from the concave is corrected by proper tilting of the plane mirror.

Since the last meeting Mr. Coates has kindly sent me the book he refers to in his letter. It is called *The Panorama of Art*, published in London by Fisher in 1825. I have made the

abstract which I give below, from which it will be seen that the particular form of telescope in question was undoubtedly made in England before 1825.

"Of reflecting telescopes the Gregorian is almost the only one made for common use. This preference seems to be owing to the neatness of its appearance, and to its being pointed towards objects in the same manner as refracting telescopes, rather than to any really intrinsic advantages which it has over the Newtonian construction. In all the reflecting telescopes we have noticed the diameter of the large mirror, on account of the interposition of the small one at the aperture, must be greater than would otherwise be required in order to enlighten the field of view sufficiently; and it may also be observed that, as specula have probably never been ground to a truly parabolic figure, the central part, the benefit of which is lost, is the most valuable portion of the whole because it would reflect the light



with the greatest regularity. To this it may be added that the difficulty of grinding a speculum increases perhaps in so great a proportion as the square of the diameter, and it is therefore of some importance to those who may undertake the construction of these instruments for themselves to make the large speculum as small as possible consistently with a given power and quantity of light. We shall therefore mention the form of a reflecting telescope which we recollect to have been shown many years ago by a self-taught optician, who, so far as we can recollect, on the question being put to him, declared himself to be the first who had adopted it. It is represented by fig. 5, pl. vii., where the great mirror is, as usual, at the bottom of the principal tube; but instead of having its axis coincident with that of the tube, it is inclined so as to throw the image upwards through an aperture for that purpose to no , whence the rays diverge, and falling upon the small speculum are reflected by it to the eye, as in the Gregorian telescope. Here we have supposed the small mirror to be concave, but we are not certain whether it was so or not. It is clear the principle of it is pre-

served if the whole diameter of the mirror is employed to reflect light; and therefore it may have the small mirror convex like Cassegrain's reflector, or plane like Newton's. We can speak with confidence of the excellence of the instrument we allude to, and we gladly bear this testimony to the merit of an obscure individual who, we have reason to believe, is now deceased. He was tenacious of his optical knowledge, and reserved in speaking of it; yet he was far from an illiberal character. His mirrors were cast by himself in his own house, and every other part of the workmanship of his instruments, and the tools with which they were made, were constructed by himself. In solitude and silence, by day and by night, though surrounded by the chilling difficulties of poverty, he seems to have pursued his studies with an assiduity seldom paralleled; and the knowledge which it cost him so much to acquire he might feel it difficult to part with to a casual acquaintance. Perhaps the notice we have taken of him in this place may be more than is called for by any proof we have given of his abilities in the new arrangement of a telescope, but the example may be an encouragement to others, and ought not to be lost."

1895 April 2.

Note on the Observations for Coincidence of the Collimators in Flexure Determinations with the Transit Circle of the Royal Observatory, Greenwich.

(Communicated by the Astronomer Royal.)

In the Introduction to the *Cape Catalogue* for 1885 Dr. Gill (p. 35) repeats the suggestion made by Professor Newcomb ("North Polar Distances of the Greenwich Transit Circle," p. 416) that a possible cause for the apparent change of flexure of the transit circle since the piercing of the cube in 1864 September may be found in the systematic error introduced in viewing the wires of the collimator through the cube. Some observations for coincidence of the wires of the N. and S. collimators, viewed respectively through the cube and with the transit circle raised, were made in 1884 and 1885 to test this point, but by inadvertence this was not mentioned in publishing the resulting flexure determinations, and the readings for coincidence of the collimator-wires by the two methods were not given. This seems a favourable opportunity for placing them on record.

Determinations of flexure were made according to the following scheme:—

- (1) Ten readings of S. collimator on N. collimator through the cube.
- (2) Ten circle readings on each of the collimators.
- (3) Ten readings of S. collimator on N. collimator through the cube.

(4) Ten readings of S. collimator on N. collimator with the transit circle raised.

(5) Ten more readings of S. collimator on N. collimator with the transit circle raised.

(6) Ten readings of S. collimator on N. collimator through the cube.

(7) Ten circle readings on each of the collimators.

(8) Ten readings of S. collimator on N. collimator through the cube.

The reversion-prism eye-piece was employed in these observations except on 1885 May 20, so as to eliminate any personality depending on the apparent direction of measurement.

This lengthy programme was not always fully carried out.

The results of the observations, as far as they refer to the readings of the collimators, are given in the following table :—

Readings of Micrometer of S. on N. Collimator.								
Date.	Observer.	Through Cube.	Through Cube.	Transit Circle raised.	Transit Circle raised.	Through Cube.	Through Cube.	
1884. d h		r	r	r	r	r	r	
Sept. 8 22	A.D.	·362	·368	·362	·367	·373	·379	
		·092	·087	·071	...	·079	...	
29 0	H.	·084	·077	·081	...	·089	...	
		·413	·413	·423	·450	·464	·465	
Oct. 5 23	T.	·417	·418	·422	·451	·473	·469	
20 1	H.T.	·284	·280	·279	...	·259	·267	
1885. May 20 0	T.	·347	·353	·348	...	·350	·348	

The value of 1 rev. of the micrometer is $24''\cdot 17$.

On 1884 September 29 and October 5 the observers took 20 readings in each case. The means of the first and second 10 readings are set down separately.

On October 5, between the two sets of observations with the transit circle raised, readings of the N. on the S. collimator were taken. The progressive change in the readings was probably due to the Sun shining on the S. collimator.

The following table shows the means of the readings respectively through the cube and with the transit circle raised, and the differences :—

Reading of Micrometer.				
Date.	Through Cube.	Transit Circle raised.	Difference.	Difference expressed in Arc.
	r	r	r	
Sept. 8	·370	·365	+·005	+·12
	·086	·071	+·015	+·36
29	·084	·081	+·003	+·07
	·439	·437	+·002	+·05
Oct. 5	·444	·437	+·007	+·17
20	·272	·279	—·007	—·16
May 20	·349	·348	+·001	+·02

The mean of the quantities tabulated in the last column is $+ 0''.09$. Only one-half of this difference affects the flexure, so that the difference in the horizontal flexure obtained by taking the observations through the cube instead of with the transit circle raised is only $+ 0''.045$.

Observations of Occultations of Stars during the Total Eclipse of the Moon on 1895 March 10, made at the Royal Observatory, Greenwich.

(Communicated by the Astronomer Royal.)

The night was very clear till after totality ended, so that altogether 139 occultations of stars were recorded by eleven observers: twelve of these are bracketed as being presumably erroneous, five of them are solitary observations of the disappearance of 10th or 11th magnitude stars, and the times of disappearance of two stars were noted by only two observers, and as there was a discordance of several seconds between them no reliable mean could be taken. Omitting these, there are 120 good observations of disappearance or reappearance.

The observers and instruments used are given in the following table:—

Observer's Initials.	Observer's Name.	Instrument.	Aperture.	Power.	Clock used.
D.	Mr. Dyson	Merz Equatorial	in. 13	220	Dent 1793
L.	Mr. Lewis	28-inch Equatorial	28	200	Dent 2009
H.	Mr. Hollis	{ Guiding Telescope of Astrographic Equatorial }	10	225	Dent 2017
A.C.	Mr. Crommelin	Sheepshanks Equatorial	6.7	55	Earnshaw
B.	Mr. Bryant	Altazimuth	4	100	Graham I.
G.E.N.	Mr. Niblett	Corbett Equatorial	6	200	Dent 2009
A.E.	Miss Everett	{ Simms' Portable Telescope, No. 1 }	4	60	Arnold 84*
H.F.	Mr. Furner	{ R. O. Detached Telescope, No. 1 }	4	60	Appleton 484*
C.D.	Mr. Davidson	{ R. O. Detached Telescope, No. 2 }	4	60	Loseby 111*
D.E.	Mr. Edney	{ R. O. Detached Telescope, No. 3 }	4	60	Kullberg 5226*
J.	Mr. Johns	Astrographic Equatorial	13	...	Dent 2017

* Chronometer.

The Corbett equatorial was on the same mounting as the 28-inch.

H. F. observed from the leads just south of the Sheepshanks equatorial.

C. D. and D. E. observed from the roof of the new Physical Observatory.

A. E. observed from the roof of a house, No. 18 The Circus, Greenwich, 500 yards due west of the transit circle.

Seven stars were observed both at disappearance and reappearance, the number of independent measures of chords available for determination of the Moon's diameter being 49. Unfortunately all of these are considerably to the north of the Moon's centre.

The results of the observations are given in the table below. The first column gives the name of the star, the second its magnitude. The letter in the third column indicates whether a disappearance or a reappearance was observed. The next ten columns give the seconds of Greenwich mean time of disappearance or reappearance, according to the ten observers stationed in the Royal Observatory. The next column gives the concluded mean time of the phenomenon. The last column gives the seconds of Greenwich mean time according to Miss Everett, who observed from the roof of a house (No. 18 The Circus, Greenwich) 500 yards due west of the transit circle. The corrections required to reduce her observations to those made in the Observatory are $+0^s.43$ for 83 *Leonis* (D) and $+0^s.06$ for W.B. XI. 365 (R). The correction has not been computed for the other observations.

Star's Name.	Mag.	Seconds of G.M.T. by different observers.										Concluded G.M.T.			Seconds of G.M.T. by A. E.	
		D.	L.	H.	A. C.	B.	G. E. N.	H. F.	C. D.	D. E.	J.	h	m	s		
82 Leonis	6.9	D.	...	34.9	38.7	...	...	...	...	...	...	13	34	...		
83 Leonis	6.9	D.	28.2	28.2	28.0	28.3	28.3	28.8	29.3	28.7	28.3	28.0	14	17	28.42	27.5
Pi. XI. 71	8.1	D.	6.4	6.3	6.2	6.6	6.7	6.2	(8.3)	7.0	6.4	6.8	14	18	6.52	(46.2)
Anon. <i>a</i>	10	D.	...	...	56.4	...	...	...	...	...	...	...	14	44	56.4	...
τ Leonis	5.2	D.	18.9	18.8	19.1	19.1	19.5	18.8	19.2	20.4	19.4	19.4	14	56	19.27	19.3
W.B. XI. 349	8.0	D.	32.4	32.9	32.8	33.0	32.9	(31.8)	32.0	33.3	33.5	32.8	14	56	32.84	32.8
Anon. <i>b</i>	10	D.	...	49.9	46.9	...	...	...	...	...	...	...	14	58	...	...
Anon. <i>c</i>	10	D.	...	24.0	...	...	...	...	...	...	...	...	15	4	24.0	...
83 Leonis	6.9	R.	6.8	(8.3)	6.3	6.9	6.8	(5.3)	6.1	7.5	7.5	5.9	15	12	6.70	6.7
Pi. XI. 71	8.1	R.	8.8	(11.4)	9.2	9.9	9.9	...	10.1	10.3	10.4	9.0	15	13	9.69	10.0
W.B. XI. 365	7.9	D.	39.8	39.1	39.0	39.5	39.5	(36.5)	39.1	39.7	39.7	39.0	15	13	39.37	39.3
B.D. + 3° 25.01	9.5	R.	...	...	0.7	...	...	...	(2.1)	...	...	...	15	18	0.7	...
Anon. <i>d</i>	10	D.	...	42.0	...	...	...	...	...	...	...	...	15	20	42.0	...
Anon. <i>a</i>	10	R.	27.9	...	...	...	...	...	...	...	...	...	15	29	27.9	...
Anon. <i>e</i>	10	D.	...	43.4	...	...	...	...	...	...	...	...	15	29	43.4	...
W.B. XI. 372	8.8	D.	20.8	21.4	21.3	21.0	21.7	21.4	21.7	21.8	22.5	21.3	15	35	21.47	21.3
τ Leonis	5.2	R.	52.9	53.1	52.7	52.7	53.2	...	51.9	53.4	53.4	52.9	15	43	52.89	53.4
W.B. XI. 349	8.0	R.	(27.9)	24.5	24.7	24.8	25.2	...	25.0	25.7	25.4	25.3	15	47	25.07	25.3

Star's Name.	Mag.	Seconds of G.M.T. by different observers.										Seconds of G.M.T. by A. E.	
		D.	L.	H.	A. C.	B.	G. E. N.	H. F.	C. D.	D. E.	J.	Concluded G.M.T.	
		s	s	s	s	s	s	s	s	s	^g	h m s	
B.D. + 3° 2510	9.4	...	39.8	39.6	(32.1)	...	39.9	...	...	...	(28.4)	15 57 39.76	
W.B. XI. 365	7.9	...	21.8	22.6	22.3	22.5	21.6	21.8	22.6	23.0	22.5	15 58 22.30	
W.B. XI. 372	8.8	...	(37.2)	30.0	30.1	30.6	...	25.6	...	30.6	...	16 9 30.17	

Notes.

82 Leonis.—This star disappeared at the Moon's bright limb. All the other phenomena were at the eclipsed limb.

83 Leonis (D.)—A. E.'s time has been diminished 10".

Pi. XI. 71 (D.)—A. E. noted that her count of seconds was almost certainly erroneous. H. F. noted observation doubtful; wind shook instrument.

7 Leonis (D.)—D. E. noted that his count of seconds was probably one second in error.

W.B. XI. 349 (D.)—D. E. noted that his count of seconds was probably one second in error.

Anon. *b* (D.)—Angle from Vertex towards East 80°.

83 Leonis (R.)—C. D. noted that the star was on the edge of field.

Pi. XI. 71 (R.)—B. was doubtful if his count of seconds was correct. A. E.'s time has been diminished 10".

W.B. XI. 365 (D.)—D. noted that his count of seconds was possibly in error.

B.D. + 3°, 2501 (R.)—H. noted did not appear suddenly. H. F. noted probably late, star very faint. H. F.'s time has been diminished 1".

Anon. *d* (D.)—Angle from Vertex to East 105°.

Anon. *e* (D.)—Angle from Vertex to East 45°.

W.B. XI. 372 (D.)—D.'s time has been increased 10". A. C. and A. E. both noted that this star appeared projected on the Moon's limb before disappearance.

7 Leonis (R.)—A. E.'s count of seconds interfered with by a clock striking.

B.D. + 3°, 2510 (D.)—A. C. and J. both noted the observation as doubtful; they appear to have lost sight of the star before it reached the limb.

W.B. XI. 365 (R.)—H.'s time has been diminished 1". D. E. noted that his count of seconds was probably half a second in error. J.'s time has been diminished 10".

W.B. XI. 372 (R.)—L. noted that his count of seconds was probably six or seven seconds in error.

Observations of Contacts with Shadow.

Phenomenon.		Observer.	G.M.T.		
			h	m	s
First Contact with Shadow	...	A. C.	13	55	4
		B.	13	53	23
Beginning of Totality	...	A. C.	14	52	5
		B.	14	51	55
		H. F.	14	52	6
End of Totality	...	A. C.	16	25	13*

Royal Observatory, Greenwich:
1895 March 26.

*Observations of Occultations of Stars during the Total Lunar Eclipse of 1895 March 10 at the Radcliffe Observatory, Oxford.**(Communicated by E. J. Stone, M.A., F.R.S., Radcliffe Observer.)*

The following occultations were observed by Mr. Wickham with the 10-inch Barclay equatorial, using power 90 and solar chronometer; and by Mr. Robinson with the 7.5-inch heliometer, using power 80 and sidereal clock. The night was exceptionally fine.

Name of Star.	Mag.	Phenomenon.	Time noted.			G.M.T. of Observation.			Observer.
			h	m	s	h	m	s	
83 Leonis	7.5	Disappearance	14	17	33.3	14	15	32.1	W.
"	"	"	13	23	49.0	14	15	32.3	R.
Piazzi XI. 71	8.0	"	14	18	11.25	14	16	10.0	W.
"	"	"	13	24	27.0	14	16	10.2	R.
τ Leonis	5.0	"	14	56	24.9	14	54	23.4	W.
"	"	"	14	2	46.3	14	54	23.2	R.
W.B. XI. 349	8.2	"	14	56	42.9	14	54	41.4	W.
"	"	"	14	3	4.5	14	54	41.4	R.
83 Leonis	7.5	Reappearance	15	13	8.8	15	11	7.1	W.
"	"	"	14 (19)	32	5	15	11	6.6	R.
Piazzi XI. 71	8.0	"	15	14	12.0	15	12	10.4	W.
"	"	"	14 (20)	35	9	15	12	9.9	R.
Arg. Z. + 3°, 2501	9.5	"	15	18	32	15	16	30.3	W.
W.B. XI. 372	8.8	Disappearance	15	35	26.3	15	33	24.5	W.
"	"	"	14	41	54.25	15	33	24.7	R.
τ Leonis	5.0	Reappearance	15	45	6.3	15	43	4.4	W.
"	"	"	14	51	35.6	15	43	4.4	R.
W.B. XI. 349	8.2	"	15	43	35.8	15	46	33.9	W.
W.B. XI. 372	8.8	"	16	10	59.8	16	8	57.7	W.

* Rough observation; cloudy.

Observers' Remarks.

Mr. Wickham : Arg. Z. + 3°, 2501.—The time noted may be 1^s late. Star very faint. W.B. XI. 365.—Having watched for several minutes after the predicted time, given in *The Observatory* for March 1895, for the reappearance, I had just given up the count when the star flashed out from the limb. I then picked up the count of the seconds, and on reference to the chronometer inferred the approximate time of reappearance to be 15^h 59^m 46^s, or 15^h 57^m 44^s G.M.T.

At 15^h 36^m G.M.T., about the middle of the eclipse, examined the Moon by naked eye. The usual deep copper colour prevailed; the large blackish patch, occupying the centre, and diminishing in darkness towards the limb, was a striking feature of the eclipse. The effects of irradiation were strongly marked as the Moon emerged from the shadow; the illuminated portion, by contrast, appeared intensely bright, and distinctly projected beyond the darkened limb. During totality the background of the sky was very black, the Milky Way, clusters, and small stars being unusually well defined. The definition in the telescope was very good, and at totality the markings of the Moon were easily distinguished near the limb, but not at the centre.

Mr. Robinson : The observations were in every case satisfactory. All the occultations were instantaneous, excepting only the reappearance of γ Leonis, which seemed to take about 0^s.2 in acquiring full brightness. When the total phase of the eclipse was nearly complete the uneclipsed crescent presented a distinctly blue colour by contrast with the usual ruddy hue, which was very pronounced over the rest of the disc.

Radcliffe Observatory, Oxford :
1895 March 19.

Note on the Total Eclipse of the Moon, 1895 March 10.

By H. F. Newall, M.A.

The following occultations of stars were observed with the Newall Telescope, Cambridge Observatory, during the eclipse, under very favourable atmospheric conditions. The times were noted on a chronometer beating 100 to a minute. The writer observed within earshot of the chronometer, and at the moment of a disappearance or reappearance of a star began counting with the chronometer, having previously been attentive to the beats; his assistant, A. W. Goatcher, took up the counting and read off the chronometer.

With one exception, the recorded observations are considered certain within half a beat of the chronometer, that is, within 0^s.3. The recorded time for the reappearance of the star No. 5 on Dr. Döllén's list is considered possibly 0^s.6 late.

The observations were made with the aperture 24 inches, and with the micrometer with magnifying power 307. A micrometer wire was set so as to be a chord of a small arc of the limb of the Moon, with the observed star at the middle of the arc, as near as possible to the moment at which the star was observed to be disappearing or to have reappeared; and the parallel was determined by allowing a star to trail along the wire; from

these data the position angle measured from the north-point was determined for many of the occultations.

All the disappearances seemed to be instantaneous, without any trace of fluctuations of brightness.

The stars observed have been identified with those on Dr. Döllén's list, though the observations were made without knowledge of Dr. Döllén's list prepared for the Cambridge Observatory.

*Dr. Döllén's List.**Observations.*

No.	Mag.	Time.		Q.	Recorded Mag.	Recorded Q.	Recorded Time.		Chronom. Slow.	Greenwich Mean Solar Time.			Phenomenon.	
		h	m	o		o	h	m	m	h	m	s		
3	6·9	...	...	...	7	...	13	29·37	1·767	14	16	46·4	Disappearance. Good	
4	8·1	...	...	...	8·5	95·22	13	29·99	1·767	14	17	23·5	”	”
5	5·2	14	56·0	83	5	85·49	14	8·23	1·768	14	55	31·7	”	”
6	8·0	14	56·2	88	9	...	14	8·38	1·768	14	55	40·7	”	”
7	7·9	15	13·3	80	9	81·06	14	25·59	1·768	15	12	50·4	”	”
...	...	...	...	...	10	325·84	14	43·11	1·768	15	30	18·8	Reappearance.	”
10	8·8	15	34·3	67	9	68·17	14	47·43	1·769	15	34	37·3	Disappearance.	”
5	5·2	15	43·6	345	5	344·88	14	55·26	1·769	15	42	25·8	Reappearance.	Fair
6	8·0	15	46·2	340	9	339·61	14	58·87	1·769	15	46	1·8	”	Good
...	...	...	...	...	10	120·19	15	9·34	1·769	15	56	28·3	Disappearance.	”

Both before and after totality the part of the shaded Moon near the edge of the shadow was grey blue, and the change of colour along a radius of the shadow-disc was as in a spectrum, grey blue at the boundary of the shadow passing through green and tawny yellow to dusky red. When the encroaching shadow-edge passed through Billy and Hansteen the limb of the Moon was already reddish, and it was noted throughout the eclipse that the dusky red was more marked on the southern parts than on the northern parts of the Moon's disc.

Occultations observed at Harrow during the Total Eclipse of the Moon, 1895 March 10. By Lieut.-Colonel G. L. Tupman.

		Harrow Sidereal Time.			Greenwich Mean Time.		
		h	m	s	h	m	s
83 Leonis	Dis.	13	29	36.45	14	16	57.24
„	Reap.	14	24	36.39	15	11	48.18
P. XI. 71	Reap.	14	25	39.97	15	12	51.58
τ Leonis	Dis.	14	8	32.00	14	55	46.42
„	Reap.*	14	56	30.47	15	43	37.03
LL 21847	Dis.	14	47	41.23	15	34	49.23
LL 21819	Dis.	14	8	47.04	14	56	1.42
„	Reap.	15	0	3.14	15	47	9.12
LL 21833	Dis.	14	25	56.71	15	13	8.28

Place of observation (about 188 feet south of the transit circle) in latitude $51^{\circ} 34' 45''.5$, longitude $0^{\text{h}} 1^{\text{m}} 19^{\text{s}}.86$ W. Height above sea 220 feet. The clock-correction was determined March 10 and 11.

Total Eclipse of the Moon, 1895 March 10. By G. J. Newbegin.

Six photographs of the lunar eclipse were taken by me at Thorpe Observatory in the focus of 9-inch Cooke equatorial: the first at $14^{\text{h}} 6^{\text{m}}$ after immersion in Earth's shadow, which had by this time well advanced. The second was taken at $14^{\text{h}} 30^{\text{m}}$, showing the shadow so far advanced as to cover quite two-thirds of the Moon. My third plate was exposed at $14^{\text{h}} 55^{\text{m}}$, three minutes after commencement of total phase, the Moon still showing considerable brightness in the region last immersed, and τ Leonis not yet occulted. Being in doubt as to what exposure to give, I tripled it, hopeful of securing some trace of the Moon, and also the star so near occultation. Hope is one thing, reality another; the plate came out a complete blank, not the least trace of anything being visible. At $15^{\text{h}} 30^{\text{m}}$ I tried once more, the Moon having now reached very nearly central totality. This time I increased the former exposure twenty times, again wondering what the result might be. Result—a blank plate, with somewhat more light in it. I then decided not to expose until the emergence of the Moon from Earth's shadow, and meanwhile made only visual notes, from which I now quote:— $15^{\text{h}} 30^{\text{m}}$, S.E. of Moon quite copper-coloured, N.W. silver-edged.

* Reap. of τ Leonis was not instantaneous.

15^h 50^m, N. silver-edged. 16^h 10^m, from N. to S.E. silver-edged, which region continued brightening until end of total phase at 16^h 26^m 6^s. It would be difficult to say at what particular second one could be certain the Moon had emerged, but I feel certain the time named was extremely near. At 16^h 30^m, or about 3¹/₂^m after emergence, I again exposed a plate, and secured a very faint segment of the reappearing Moon. My last plate was exposed at 17^h, dawn having commenced. By this time three-fifths of the Moon had reappeared, and the eclipse of 1895 March 10 was practically over.

Times of Exposure.			Times of Exposure.		
h	s		h	s	
14	20	2-inch aperture	15:30	60	9-inch aperture
14:30	20	" "	16:30	30	2-inch "
14:55	60	" "	17	20	" "

Solar Eclipse, 1895 March 25. By G. J. Newbegin.

On this occasion so many clouds were passing from the N.W. that I can only say my first observation of the eclipse was at 22^h 4^m G.M.T., when it had already begun, but certainly only just begun. At 22^h 13^m I took this photograph: it was then or never as far as sky was concerned. I estimate it to have been then at its maximum. At 22^h 24^m I had one more peep, when, to my eye, the eclipse was over.

Partial Eclipse of the Sun, 1895 March 25. By Professor Arthur A. Rambaut, M.A., Sc.D.

At Dunsink on the morning of the eclipse the sky was flecked with clouds which occasionally obscured the Sun. We missed the first contact, but the time of egress was well determined, the definition being very good at the time.

This phase occurred at 10^h 42^m 42^s.8 G.M.T.

Dunsink: 1895 April 10.

*Observation of the Partial Solar Eclipse of 1895 March 25 at the
Armagh Observatory. By J. L. E. Dreyer, Ph.D.*

With a power of 100 on the 10-inch refractor the contacts were observed as follow :—

Beginning $21^h 36^m 18.2$ Greenwich M.T.
End . : $22 \quad 45 \quad 43.2$ Greenwich M.T.

The definition was very good, and both observations were considered satisfactory.

*Armagh Observatory :
1895 April 9.*

*Notes on the Variable Stars X and W Sagittarii.
By Lieut.-Col. E. E. Markwick.*

Twenty-two observations of *X Sagittarii* have been secured in 1894, which are detailed in the table following. The first column gives the calendar date, the second the Julian, the third the observed brightness, the fourth the days elapsed from last preceding maximum calculated on Dr. Chandler's data (period, 7.01185 days) and date of observation, and the fifth the difference in days between observation and calculation. This last has been arrived at by plotting the observations on a typical curve, and measuring off their horizontal distance from the curve, those to the left being negative, and right, positive. For convenience the scale has been taken at : 1 day, horizontal, = .25 inch, 1 tenth of a magnitude, vertical, = .125 inch.

I much regret that the "O—C" column for this star on p. 141, vol. liv. of the *Monthly Notices* is incorrect. In calculating the dates of maxima for 1893 the Julian figures were correctly ascertained, but unfortunately the calendar dates were wrongly taken out by one day, and hence O—C is affected on that page with an error of one day. I have now carefully revised the figures, and the following are the results, compared with last year's observations :

X Sagittarii.	No. of Obs.	Sum of positive residuals.	Sum of Negative residuals.
1893	40	7.2	22.8
1894	22	1.8	16.2

If my observations are reliable, these figures would appear to indicate that on the whole the period is a trifle too long, and wants bringing back a very little.

X Sagittarii.

Date, 1894.	Julian, 2 410,000 ¹ + d	Observed brightness.	After Max. d.	O—C, d.
Aug. 20.40	3061.40	5.7	4.81	—0.8
23.43	3064.43	5.7	0.83	—2.6
25.38	3066.38	5.7	2.78	—0.8
26.38	3067.38	5.5	3.78	+0.6
27.32	3068.32	5.1	4.72	—1.5
27.37	3068.37	5.7	4.77	—0.9
28.38	3069.38	5.1	5.78	—0.4
Sept. 4.39	3076.39	5.5	5.77	—0.1
20.38	3092.38	5.2	0.73	—1.8
21.32	3093.32	5.3	1.67	—1.1
22.32	3094.32	5.4	2.67	—0.3
22.38	3094.38	5.5	2.73	—0.4
24.32	3096.32	5.6	4.67	—1.1
25.32	3097.32	5.7	5.67	0.0
25.37	3097.37	5.4	5.72	—0.2
26.31	3098.31	4.8	6.66	+0.2
29.30	3101.30	5.5	2.64	—0.5
Oct. 1.31	3103.31	5.6	4.65	—1.1
2.33	3104.33	5.9	5.67	+0.4
4.31	3106.31	5.6	0.64	—2.6
21.29	3123.29	5.7	3.60	+0.1
27.29	3129.29	5.0	2.58	+0.5

W Sagittarii.—The observations follow, arranged in the same way as those of the preceding star. I have also recomputed the observations for 1893, using Dr. Chandler's period, 7.59460 days. The results come out :

	No. of Observations.	Sum of positive residuals.	Sum of negative residuals.
1893	43	10.0	14.5
1894	26	5.1	12.5

The negative residuals in 1894 might be reduced by 2.9, by the omission of an observation on October 31, which was unreliable owing to the low altitude of the star. On the whole I do not think that the observations of 1894 are sufficiently numerous for any correction to the period to be deduced with any certainty. If the negative ones increased systematically in the future, of course the period adopted would be a little too large, but seeing that a much larger number of observations was obtained in 1893, and that the positive and negative residuals

then came out more nearly equal, it would not appear that any correction to the period is necessary at present.

The observations were made with a binocular, magnifying about five times. *W* was usually compared with 14 (U.A.) of same constellation, and *X* with F 4 *Sagittarii*.

W Sagittarii.

Date. 1894.	Julian, 2 470 000 ^d + d	Observed brightness.	After Max. d.	O-O. d.
Aug. 20.40	3061.40	5.6	4.81	-0.7
23.43	3064.43	5.1	0.24	-1.5
25.39	3066.39	5.45	2.20	-0.5
26.38	3067.38	5.5	3.19	+0.2
26.43	3067.43	5.5	3.24	+0.2
27.32	3068.32	5.8	4.13	-0.4
27.37	3068.37	5.8	4.18	-0.4
28.38	3069.38	5.5	5.19	-0.6
Sept. 4.39	3076.39	5.8	4.61	+0.2
16.32	3088.32	5.0	1.35	0.0
20.38	3092.38	5.8	5.41	+0.9
21.32	3093.32	4.9	6.35	-0.5
22.32	3094.32	5.2	7.35	+1.1
22.38	3094.38	5.1	7.41	+1.0
24.32	3096.32	5.1	1.76	0.0
25.32	3097.32	5.5	2.76	-0.2
25.37	3097.37	5.5	2.81	-0.2
26.31	3098.31	5.9	3.75	-0.8
29.30	3101.30	5.0	6.74	+0.1
Oct. 1.31	3103.31	5.3	1.15	-1.2
2.32	3104.32	5.55	2.16	-1.0
4.31	3106.31	5.7	4.15	+0.5
21.29	3123.29	5.6	5.94	+0.4
24.30	3126.30	5.5	1.36	-1.6
27.29	3129.29	5.75	4.35	+0.5
31.30	3133.30	5.7	0.76	-2.9

Gibraltar :
1895 February.

η Cassiopeiae. By Thomas Lewis.

In the *Monthly Notices*, vol. lv. 1, 1894 November, in my remarks on the orbit of η Cassiopeiae, on page 20, "the combined mass is 3.54" should read "the combined mass is 1.69."

I take this opportunity of sending an extract from a letter received from Mr. Hermann S. Davis, Columbia College, New York, at the same time remarking that the parallaxes used were derived from Professor Pritchard's list. "I have only recently completed a determination of parallax for this star from Rutherford photograph measures, using six pairs of comparison stars, the result being

$$\pi = +0''.443 \pm ''043.$$

Referring to Socoloff's reduction of Schweizer's observations (*Annales de l'Observatoire de Moscou*, vol. iii. part 2), I find that the values of π given there are

$$+0''.3743 \pm ''0723 \text{ in distance}$$

and

$$+0''.1386 \pm ''0849 \text{ in position,}$$

whereas you have $0''.202$ and $0''.139$ respectively in your article. The former value is obtained by assuming that the negative sign of the coefficient k , on page 88 (*Annales*), is a misprint for +.

"If, however, we adopt the author's own interpretation, we get $0''.374$, as given on page 89 (*Annales*)."

With this corrected value and Mr. Davis's new result, the mean parallax of η Cassiopeiae is $0''.285$.

1895 March 30.

*Equatorial Comparisons of Jupiter and 1 Geminorum, 1895
January 5 and 10. By John Tebbutt.*

In consequence of cloudy weather, which has prevailed here almost uninterruptedly since the beginning of the year, I only succeeded in getting comparisons of *Jupiter* and *1 Geminorum* on two nights with the filar micrometer on the 8-inch equatorial. On January 5 I obtained twenty-four comparisons on the single thread of the micrometer, in each of which both limbs of the planet were observed, the corresponding comparisons for difference of declination being equally divided between the north and south limbs. On the 10th twenty comparisons were similarly made. The corrections for phase and refraction are in-

sensible. The planet's semidiameter on page 280 of the *Nautical Almanac* is employed in the reductions of the differences of declination from the limbs to the centre, and the mean place of the star is derived from the Greenwich Five-year Catalogue of 258 fundamental stars. The tabular places of the planet are interpolated with second differences from page 250 of the *Nautical Almanac*. As the steadiness and definition of the objects were satisfactory, it is hoped that the tabular corrections will bear favourable comparison with those derived from meridian observations.

Windsor M.T. of mean of transit of					d	h	m	s	d	h	m	s	
planet's centre					Jan. 5	12	50	8	Jan. 10	10	46	35	
							h	m	s		h	m	s
Adopted mean R.A. of star for 1895.0 ...							5	57	44.20		5	57	44.20
Reduction to apparent R.A. for date ...								+	1.62			+	1.64
Planet's centre—star								—	4.43			—	2 41.19
Correction for parallax								+	0.06			+	0.01
Concluded geocentric apparent R.A. of planet							5	57	41.45		5	55	4.66
Geocentric apparent R.A. from <i>Nautical Almanac</i>							5	57	41.14		5	55	4.26
Correction for <i>Nautical Almanac</i>								+	0.31			+	0.40
Adopted mean Declin. of star for 1895.0 ...							+23	16	6.8		+23	16	6.8
Reduction to apparent Declin. for date ...								+	8.7			+	8.7
Planet's centre—star								—	41.9			—	9.0
Correction for parallax								—	1.7			—	1.8
Concluded geocentric apparent Declin. of planet							+23	15	31.9		+23	16	4.7
Geocentric apparent Declin. from <i>Nautical Almanac</i>							+23	15	32.0		+23	16	4.2
Correction for <i>Nautical Almanac</i>								—	0.1			+	0.5

The Observatory, Windsor, N.S. Wales :
1895 February 3.

Occultation of Antares, 1894 October 31. By R. T. A. Innes.

I observed this occultation using Mr. W. F. Gale's $6\frac{1}{4}$ -inch refractor, by T. Cooke. Power of eye-piece about 190. The disappearance in sunlight was instantaneous; the reappearance was after sunset, but still in strong daylight. My eye was fortunately fixed on the spot of reappearance. I noticed a faint bluish light, which, whilst I was wondering what it was, seemed to stretch towards the Moon's limb; then *Antares* flashed out ruddy and all but instantaneously. I then saw that the faint light which I first perceived was the companion, which was immediately well separated from *Antares*. I called two ladies who were near the telescope, and they both saw the companion without any prompting. Until *Antares* emerged the companion seemed to be connected with it or the Moon's limb by an electric arc. Definition perfect.

Sydney:

1895 February 21.

Pallas and Vesta in 1895. By W. W. Bryant.

Pallas is very well placed this year for observation in the northern hemisphere, and as it might be interesting to take differential observations of it in comparison with bright stars, such as are easily within reach of small telescopes, I have made out a list of some such stars (within the limits of the B.A. Catalogue) as lie nearly in the track of the planet.

I have done the same for *Vesta*, though its south declination makes it much less convenient, especially as it makes it rise so late for some time. Still it passes near some well-known stars, notably ϵ *Aquarii*.

Pallas.

Date.	Star's Name	Mag.	Mean for Year.		Planet's place at Greenwich.		Daily Change	Approximate Civil	
			R.A.	Decl.	R.A.	Decl.	of Decl.	Rising.	Time of Setting.
			h m	° '	h m	° '			
May 21	79 Herculis	6	17 33.2	+24 22	17 35.4	+24 20	+ 6½	Up all night.	
June 30	62 Herculis	7½	17 4 2	+24 38	17 3 1	+24 39	- 5	Sets just before sunrise.	
Aug. 9	54 Herculis	5½	16 50.8	+18 36	16 50.6	+18 34	-11	...	3.30 A.M.
Aug. 25	B.F. 2341	6½	16 53.9	+15 36	16 54.6	+15 31	-11	...	2 A.M.
Aug. 27	B.F. 2345	6	16 56.8	+15 6	16 55.5	+15 8	-11	...	...
Sept. 1	Bradley 2163	5½	16 58.3	+14 15	16 57.9	+14 12	-11	...	...
Sept. 4	Bradley 2164	6½	16 58.8	+13 45	16 59.5	+13 38	-11	...	...
Sept. 4	Bradley 2166	6	16 59.1	+13 43		+12 54	-11	...	1 A.M.
Sept. 8	60 Herculis	5	17 0.5	+12 53	17 1.9	+12 54	-11	...	...

Vesta.

May 10	4 Aquarii	4½	22 0.8	-14 23	22 2.1	-14 23	- 4½	2 A.M.	...
May 18	45 Aquarii	6	22 13.4	-13 50	22 13.5	-13 49	- 3½	1.30 A.M.	...
May 25	Bradley 2961	6½	22 24.4	-13 27	22 22.0	-13 28	- 3	1 A.M.	...
July 7	Piazzi XXII. 264	7	22 54.1	-13 38	22 54.1	-13 37	+ 3	11 P.M.	...
Aug. 2	8 Aquarii	3	22 49.1	-16 23	22 49.6	-16 23	+ 8	9 P.M.	...
Aug. 5	77 Aquarii	6	22 49.2	-16 50	22 47.8	-16 47	+ 8	9 P.M.	...
Sept. 17	41 Aquarii	6	22 8.5	-21 36	22 12.4	-21 37	+ 2	...	2.30 A.M.
Oct. 7	Piazzi XXI. 419	7	22 5.2	-21 45	22 4.9	-21 46	- 1½	...	1 A.M.
Nov. 20	61 Aquarii	6½	22 30.2	-18 0	22 26.4	-18 2	- 7	...	11 P.M.

Note.—May 9-17 and Aug. 5-13 Saturn is near κ Virginis and 96 Virginis.